

# World Trade Center

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**Asbestos Site Evaluation, Communication and Cleanup**

Keystone, Colorado  
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# SITE BACKGROUND

## Overview

- Collapse of the World Trade Center – unprecedented disaster
- Large area of dust deposition in an urban environment
- Conflicting information on asbestos usage and replacement with Zonolite



# EPA Program Components

(Many other non-EPA activities)

- COPC/Benchmark Report
  - Identify Contaminants of Potential Concern
- Confirmation Cleaning Study
  - Confirm effectiveness of cleanup techniques
- Background Study
  - Collect data on background levels in upper Manhattan
- WTC Dust Cleanup Program
  - Clean residential spaces upon request (apartments, common spaces, HVACs)
    - Voluntary, residential units south of Canal Street in lower Manhattan



# SITE BACKGROUND

## Geography/Affected Area

- Dust cloud radiating out from World Trade Center (Ground Zero) through lower Manhattan
- Lower mass of dust/debris traversed the East river to Brooklyn



# Regional Asbestos / Particulate Monitoring Sites Implemented In Response to the Attack on the World Trade Center

## Monitoring Sites

- Site 1 - Park Row
  - Site 2 - Chambers and West St.
  - Site 3 - US Coast Guard Building - INACTIVE
  - Site 4 \* - Canal Street
  - Site 5 - Public School 154, 333 East 135th St.
  - Site 6 - Intermediate School 143, 511 West 182 St.
  - Site 7 - Public School 274, 800 Bushwick Ave.
  - Site 8 - Public School 44, 80 Maple Parkway
  - Site 9 - Public School 199, 3290 48th Ave.
  - Site 10 \* - Liberty State Park
  - Site 11 \* - Rahway NJ Waterworks, 1045 Westfield Ave.
  - Site 12 \* - Maspeth Library, 69-70 Grand Ave.
  - Site 13 \* - Public School 64, 600 East 6th St.
  - Site 14 \* - Albany St., Battery Park City
  - Site 15 \* - Broad St. & Wall Street
  - Site 16 \* - EPA/ORD Network Site
- \* Particulate Monitoring only

2 0 2 4 6 Miles

Map Date : January 21, 2002





# SITE BACKGROUND

## Populations Affected

- Disaster Response Workers
  - Emergency response workers/volunteers
  - Iron/construction workers
  - Day laborers
- Office workers
- Residents
- Visitors





# SITE BACKGROUND

## Mineral Forms of Asbestos

- Outdoor
  - Predominately chrysotile
- Indoor
  - Predominately chrysotile (878/20,877)

Asbestos Type	Detects	Asbestos Type	Detects
Chrysotile	878	Tremolite	5
Amosite	31	Crocidolite	1
Actinolite	9	Amphibole	1
Anthophyllite	6	Combination	16

\*Data presented is from Lower Manhattan Indoor Dust Cleanup Program ( $<0.5 \mu$ )




# SITE BACKGROUND

## Asbestos-Related Health Effects

- Occupational Exposure
  - Presently – none observed due to recent exposure (acute, non-asbestos effects evident)
  - Long-term – uncertain due to difficulty in dose reconstruction (e.g., variable exposure times)
- Environmental Exposure
  - Outdoor - none observed (acute, non-asbestos effects evident)
  - Indoor – sampling data suggests minimal risk for long term health impacts





## ACTIVITIES BY EXPOSURE PATHWAY – SOIL - Sampling/Analysis/Results/ Risks/Remediation

- Soil samples were not collected due to surficial deposition
- Dust that was deposited was removed by natural forces (primarily rain) or by vacuum trucks
  - Department of Sanitation (NYC)
  - NYCDEP (exterior of buildings)



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Sampling

- Methods Used
  - Wipe and microvacuum (bulk – other source)
  - Ultrasonification – Carpet (non-EPA)
- Location of Samples
  - Non-EPA - Indoor residential dwellings
  - EPA – one heavily impacted building (Confirmation Cleaning) and upper Manhattan (Background study)
- Number of Samples
  - Non-EPA – uncertain
  - EPA – Confirmation Cleaning (156 Wipe; 124 Microvac), Background Study (146 Wipe; 161 Microvac)



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Sampling (conclusion)

- Problems
  - No known problems for asbestos
  - Others mostly related to lead and dioxin sampling



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Analysis

- Mineralogic Asbestos Evaluation
  - Serpentine and six common amphiboles
- Specific Counting Procedures or Rules
  - ASTM 5755 – count fibers  $>0.5$  microns, aspect ratio 5:1
- Cleavage Fragments
  - No special rules



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Analysis (cont)

- Estimated Sensitivity to Methods
  - Minimum sensitivity  $\sim 1,000$  f/cm<sup>2</sup> (wipe and microvacuum methods)
  - Matrix interference often resulted in higher detection limits
- Deviations from Standard Protocols
  - None reported



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Analysis (conclusion)

- Issues
  - Limitations on use of K-factors to evaluate risk
  - Porous vs. hard surfaces
    - Interpretation of ultrasonification results
  - Sample location



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Results

**EPA**

CC = Confirmation  
Cleaning Study  
Pre = Pre-cleaning  
Post = Post-cleaning  
Bkg. = Background  
Study

	Wipe (s/cm <sup>2</sup> )		
	Min	Max	Mean
CC-Pre	<3164	10,967,100	372,097
CC-Post	<1582	888,172	55,493
Bkg.	<634	72,094	2,783
	Microvacuum (s/cm <sup>2</sup> )		
	Min	Max	Mean
CC-Pre	<2366	233,475	25,951
CC-Post	<738	197,860	14,322
Bkg.	<1184	3,798,910	37,174



# ACTIVITIES BY EXPOSURE PATHWAY – DUST - Remediation Strategy

- Use standard cleaning techniques
  - Specifically, HEPA vacuuming followed by wet wiping, as per Confirmation Cleaning Study
- Recommended discarding heavily contaminated (i.e., large dust load) personal items and porous materials
- Whole building – HVAC systems and common areas



# ACTIVITIES BY EXPOSURE PATHWAY – AIR -Sampling (Outdoor)

- Methods Used
  - As per TEM AHERA with modification to identify fibers > 5 microns
  - As per PCM NIOSH 7400 (used to obtain total fiber counts)
- Location of Samples
  - 20 sites ringing WTC site and Freshkill Landfill
- Number of Samples
  - Over 8,000 (~40/day for 200 days)



# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Sampling (Indoor)

- Methods Used
  - Non-EPA – standard methods
  - EPA – SKC Aircheck Samplers w/ 0.8 or 0.45 micron membranes
- Location of Samples
  - One per room, minimum 3/apartment
- Number of Samples
  - Non-EPA – uncertain
  - EPA – Lower Manhattan Cleanup (>25,000), Confirmation Cleaning (171), Background Study (64)



# ACTIVITIES BY EXPOSURE PATHWAY – **AIR - Sampling** (conclusion)

- Problems
  - Outdoor
    - Disaster conditions (e.g., no electricity)
    - Overloaded filters – due to ambient particulate concentration
  - Indoor
    - Overloaded filters – due to greater air volumes to reach lower analytical sensitivity





# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Analysis (Outdoor and Indoor)

- Mineralogic Asbestos Evaluation
  - Serpentine and six common amphiboles
- Specific Counting Procedures or Rules
  - EPA AHERA
  - EPA AHERA for PCMe
  - NIOSH 7400 (PCM)
- Cleavage Fragments
  - No special rules



# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Analysis (cont)

- Estimated Sensitivity to Methods

	Outdoor	Indoor
EPA AHERA	0.005 f/cc	0.0005 f/cc
EPA AHERA (PCMe)	0.005 f/cc	0.0005 f/cc
NIOSH 7400 (PCM)	0.01 f/cc	0.001 f/cc

- Deviations from Standard Protocols
  - Volume of air



# ACTIVITIES BY EXPOSURE PATHWAY – **AIR - Analysis** (conclusion)

- Issues
  - Outdoor
    - Adjust AHERA counts to standardized volume (i.e., 1200 liters)
  - Indoor
    - Aggressive vs. modified-aggressive
    - Definition of overloaded filter
    - Analytical sensitivity influenced target risk level



# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Results

- Personal Monitors
  - OSHA monitored WTC site workers
  - OSHA issued negative exposure assessment for indoor cleanup workers
  - EPA personal monitoring during Confirmation Cleaning Study
    - Asbestos concentrations below 0.1 f/cc (OSHA PEL) [one exception]
  - EPA personal monitoring during first 10-weeks of Lower Manhattan Indoor Dust Cleanup Program
    - All below 0.1 f/cc (OSHA PEL)
- Area Sampling
  - See next panel



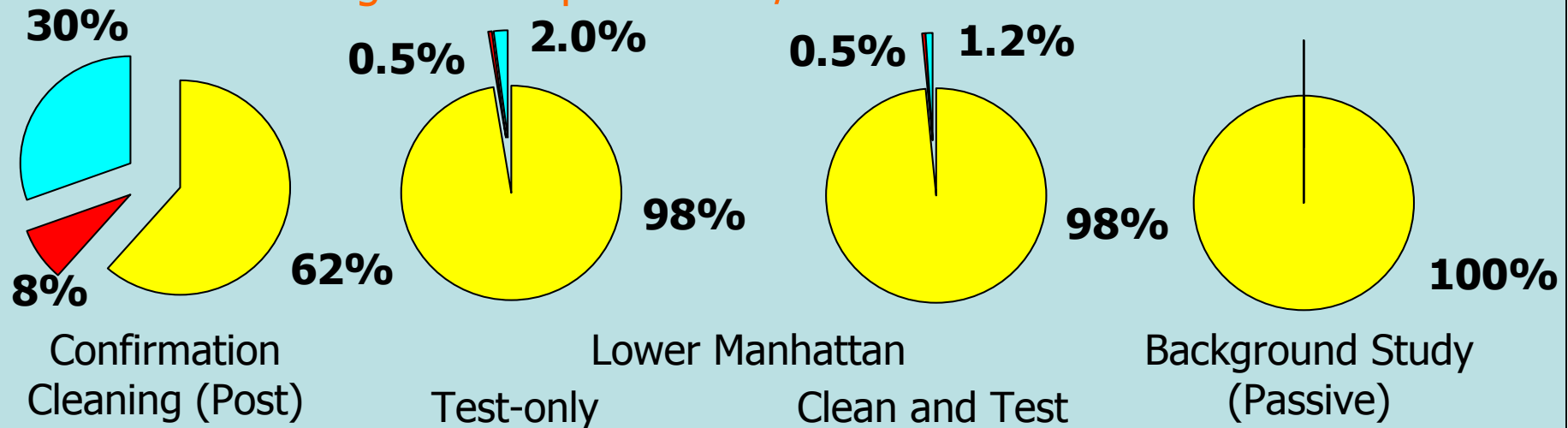
# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Estimated Risks (Outdoor)

- Risks
  - One-year risk-based value = 0.028 s/cc based on  $10^{-4}$  risk
  - AHERA standard converted to volume = 0.022 s/cc
  - Eleven samples over AHERA standard of 70 s/mm<sup>2</sup>
- Criteria Used
  - Compared results to AHERA standard (70 s/mm<sup>2</sup>)



# ACTIVITIES BY EXPOSURE PATHWAY – AIR - Estimated Risks (Indoor)

Percentage of Samples Below/Above Benchmark or Overloaded



- Risks
  - Few above health-based benchmark
- Criteria Used
  - 30-year, risk-based benchmark of 0.0009 s/cc based on  $10^{-4}$  risk

■ Below  
■ Above  
■ Overloaded





# ACTIVITIES BY EXPOSURE PATHWAY – Other Source Material Sampling

- Methods Used
  - EPA 600 R93-116 – Bulk Dust
- Location of Samples
  - Perimeter of WTC-site and various locations in lower Manhattan
- Number of Samples
  - 145
  - Samples obtained by many other groups (USGS, Rutgers, Dept. of Education)



# Other Source Material Sampling (conclusion)

- Problems
  - 1% rule does not work well for directing cleanup program
  - Total mass not taken into account



# Other Source Material Analysis

- Mineralogic Asbestos Evaluation
  - Serpentine and six common amphiboles
- Specific Counting Procedures or Rules
  - 400 point counting procedure
- Cleavage Fragments
  - No special rules



# Other Source Material

## Analysis (cont)

- Estimated Sensitivity to Methods
  - 400 point counting procedure is approximately 0.25%
- Deviations from Standard Protocols
  - None reported



# Other Source Material Analysis (conclusion)

- Issues
  - 1% rules not risk based; can be misleading



# Other Source Material Results

- $\frac{1}{4}$  of samples (37/145) were above 1%
- Range = Trace to 5.4%
- Sample obtained directly from steel I-beam contained ~40%



# Other Source Material

## Estimated Risk

- No direct extrapolation of risk
- Results used to characterize dust as potentially asbestos-containing material



# Other Source Material Remediation Strategy

- Vacuum trucks equipped with HEPA-filters
- Other techniques for removing bulk debris using engineering controls to minimize dust generation



# Site Remedial Actions – Actions Completed

- WTC-site officially completed in May 2002
- Confirmation Cleaning Study field work completed in October 2002; report May 2003
- Background Study field work completed in October 2002; report May 2003
- Lower Manhattan Indoor Dust Cleanup Program
  - Cleaning and testing completed July 2003
  - Final report due in October 2003



# Site Remedial Actions – Ongoing Site Plans

**QUESTIONS?**

**For more detail:  
[www.epa.gov/wtc](http://www.epa.gov/wtc)**

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